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## THESIS

To obtain the diploma of Master  
Field: **Computer Science**  
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### Theme

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## A Comparative Study of Web Application Security

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Presented by:  
Lachemat Mohamed Fouad  
Slamat Mohamed Souhaib

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**Dr. Alaa Eddine Belfedhal**

Supervisor

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# Abstract

This thesis explores the topic of web application security and focuses on the development and implementation of a web application firewall system.

The research aims to address the increasing threats and vulnerabilities faced by web applications in today's digital landscape. The study begins with an introduction that sets the context and outlines the research questions and objectives. The thesis is divided into two main sections: Background and State of the Art.

The Background section provides a comprehensive overview of the concepts and principles related to web application security, while the State of the Art section examines the current state of firewall technologies and their effectiveness in protecting web applications.

Overall, this research serves to advance knowledge in the field of web application security and provides actionable insights to enhance the security measures of web-based systems, ultimately ensuring their resilience against emerging threats and vulnerabilities.

## LIST OF ACRONYMS

- ABD** Anomaly-based Detection. [45](#), [46](#)
- AI** Artificial Intelligence. [25–27](#), [38](#)
- BERT** Bidirectional Encoder Representations from Transformers. [36](#), [37](#)
- CDN** content delivery network. [23](#)
- CNN** Convolutional Neural Network. [5](#), [34](#), [35](#), [44](#)
- DL** Deep Learning. [25](#)
- DNS** Domain Name System. [23](#)
- FNN** Feed Forward Neural Network. [32](#)
- GRU** Gated Recurrent Unit. [4](#), [44](#)
- HMM** The Hidden Markov Model. [42](#)
- HTTP** Hypertext Transfer Protocol. [21](#), [22](#)
- IBM** International Business Machines Corporation. [26](#)
- IDS** intrusion detection system. [21](#), [22](#)
- IoT** Internet of Things. [22](#)
- IPS** intrusion prevention system. [21](#), [22](#)
- ISO** the International Organization for Standardization. [12](#)
- LSTM** Long Short Term Memory. [34](#), [44](#)
- ML** Machine Learning. [25](#)
- MLP** Multi-Layer Perceptron. [32](#)

**NGFW** Next-generation firewalls. [22](#)

**NLP** Natural language processing. [35–37](#)

**OSI** The open systems interconnection. [12](#)

**OWASP** Open Web Application Security Project. [21](#)

**PCA** Principle Component Analysis. [44](#)

**PCI DSS** Payment Card Industry Data Security Standard. [22](#)

**RNN** Recurrent Neural Network. [5](#), [32–34](#), [44](#)

**SBD** Signature-based Detection. [45](#)

**SBDAR** Signature-Based Detection of Anomaly Requests. [45](#), [46](#)

**SBDKIT** Signature-Based Detection of Known Intrusion Types. [45](#), [46](#)

**SBDNR** Signature-Based Detection of Normal Requests. [45](#), [46](#)

**SQL** Structured Query Language. [40](#), [41](#)

**SVM** Support Vector Machine. [42](#), [43](#)

**WAF** Web application firewall. [12](#), [21–24](#), [40–42](#), [45](#)

**XSS** Cross-site scripting. [41](#)